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COMMENTS ON DETECTION METHODS OF BIRD COMMUNITIES IN URBAN BUILT ENVIRONMENTS

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Riassunto - Lo studio delle comunità ornitiche negli ambienti urbani, in particolare tramite atlanti di distribuzione, ha portato a numerosi progetti in molte città europee e nordamericane. Anche in Italia c'è stato un crescente interesse per l'avifauna urbana, con la creazione di atlanti e rassegne bibliografiche. Poiché le città sono ambienti altamente modificati dall'uomo, anche se sono presenti frammenti di habitat naturali, considerando la rapida urbanizzazione del territorio, la concentrazione della popolazione in questo ambiente e gli effetti sull'ecosistema, è importante studiare gli impatti di tali cambiamenti sulle comunità ornitiche. Sono stati proposti svariati metodi per rilevare le specie in ambienti urbani, in particolare nelle aree verdi. Tuttavia, nonostante molte città abbiano parchi molto estesi, questi studi non possono rappresentare completamente la biodiversità urbana. In questo lavoro sono stati testati svariati metodi di rilevamento nelle zone residenziali urbane con un'alta percentuale di edificato. Sono stati testati due differenti metodi di rilevamento, il conteggio su transetti e punti di ascolto. I risultati hanno mostrato differenze nelle specie rilevate, ma anche l'importanza di considerare la visibilità e i rumori di origine antropica. Sono stati effettuati confronti tra diverse variabili; ad esempio, sono stati analizzati i dati raccolti in diversi ambienti urbani, come strade parallele, diverse altezze dal suolo, diverse ore del giorno e sono state trovate differenze significative tra i dati raccolti nelle diverse circostanze. Ad esempio, il numero di individui e la composizione della popolazione possono variare notevolmente tra le diverse date e tra le diverse ore del giorno, influenzati da fattori come il rumore del traffico. Questo studio sottolinea l'importanza di adottare metodologie appropriate e considerare una vasta gamma di variabili per comprenderne appieno la dinamica e la diversità delle comunità ornitiche negli ambienti urbani.

"Più difficile è fissare sulla carta le vie delle rondini, che tagliano l'aria sopra i tetti, calano lungo parabole invisibili ad ali ferme, scartano per inghiottire una zanzara, risalgono a spirale rasente un pinnacolo, sovrastano da ogni punto dei loro sentieri d'aria tutti i punti della città." (Calvino, 1972).

INTRODUCTION

The study of avian communities within urban environments, and particularly the investigation of distribution atlases, stemming from the early pioneering efforts (Emlen, 1974; Montier, 1977), has led to the implementation of a substantial number of similar initiatives across numerous European and North American cities. In recent years, even in Italy, the interest in the avifauna of these environments has experienced a remarkable surge, leading to the creation of a considerable number of urban atlases (Fraissinet, 2023) and the compilation of a literature review of ornithological studies conducted within this environment (Dinetti, 1988).

Cities logically represent the environment most extensively modified by humans, with only few remaining fragments of pre-existing habitats (Kelcey & Rheinwald, 2005). Furthermore, considering the rapidity with which substantial stretches of natural territory are covered by human-altered environments each year (Behnisch *et al.*, 2022; Chakraborty *et al.*, 2022), the speed at which human population tends to concentrate in urban areas (Mahtta *et al.*, 2022), and the effect that urban development can have on ecosystems (e.g., Alberti, 2005; Tian *et al.*, 2022), one can grasp the significance of studying the effects of these changes on ornithocoenoses. Savard *et al.* (2000) confirmed that birds prove well for assessing and monitoring biodiversity indices. Niemelä (1999) demonstrated that urban environments can be studied without the necessity of seeking new ecological theories. Lepczyk *et al*. (2023) have proposed the concept of "cities as sanctuaries," which exemplifies the significance of cities in ecology and conservation efforts.

Several studies have addressed the issues and methodologies to be used for ornithological surveys in urban environments (e.g., Dinetti *et al.*, 1995; Kopij, 2020; Campbell *et al.*, 2022). Most ornithological studies conducted in urban environments in Italy have been carried out in parks (e.g.: Dinetti & Ascani, 1985; Lo Valvo *et al*., 1985; Battisti, 1986; Carrabba & Milone, 1991; Zarrelli, 1991; Arca *et al.*, 2005; Fraticelli, 2005). Although it is estimated that between 40 and 70% of European cities possess green areas (Sukopp & Werner 1982) and that there has been an exponential increase in studies on these environments in recent years (Chatzimentor *et al.*, 2020), they cannot be considered representative of the entirety of biodiversity in the urban ecosystem.

In this study, I aimed to experimentally test the effectiveness of certain survey methods on urban bird communities in environments with a high percentage of built-up areas: specifically, the CORINE land cover categories 1.1.1 continuous urban fabric and 1.1.2 discontinuous urban fabric (Bossard *et al.*, 2000). The distinction between these two categories is often quite subtle, and they frequently overlap with each other. A similar analysis was previously conducted by Senar (1993), primarily focusing on populations of Feral Pigeons *Columba livia*.

METHODS AND STUDY AREA

Over the years, starting from 1993, I have collected data in various settings, both in continuous urban fabric residential areas and in discontinuous and sparse urban fabric residential areas, environments related to the aforementioned CORINE categories (Bossard *et al.*, 2000), during the breeding season and other seasons. All data was collected within the cities of Rome and Ladispoli (Rome, 41°56'N – 12°05'E).

The description of the specific sites investigated is provided in individual paragraphs where, in addition to the research methods employed, I detail the corresponding assessments and challenges encountered. For statistical analysis of the data, I used the Friedman test for repeated-measures and Kolmogorov-Smirnov test of normality with a significance level of $\alpha < 0.05$.

RESULTS AND DISCUSSION

Description of the study area

Numerous studies have highlighted how the avian community can significantly vary within the same city based on environmental characteristics (e.g., Clergeau *et al.*, 1998; Plummer *et al.*, 2020; Suhonen *et al.*, 2022). Consequently, it becomes essential to establish an effective method for environmental description. Many of the methods that have been proposed for categorizing various urban habitats rely solely on vegetation (e.g., Kowarik, 1992; LEU, 1994; Toledo-Garibaldi *et al.*, 2023) or integrate vegetational data with information related to infrastructure and citizen space utilization (Schulte *et al.*, 1993; Frey, 1998, 1999). This second approach is better suited for identifying the environmental parameters that influence the presence of various avian species. Dinetti (1994) and Dinetti *et al.* (1995) proposed a classification of environmental types within urban areas, but the four categories suggested for built-up areas are inadequate for a comprehensive description when assessing the effects of the environment on avian communities. Undoubtedly, aerial photographs can facilitate the collection of crucial environmental parameters, such as building density, the presence of private gardens, distance from more natural areas, or the number and width of roads. However, these parameters cannot be deemed sufficient. An important series of elements can only be collected through a direct field survey. The height of buildings is a crucial factor, but also architectural and structural characteristics, such as wall cavities that enable nesting of certain species, play a significant role. The presence of roadside trees is a fundamental factor to consider, as it leads to species aggregations (White *et al.*, 2005). The term *small-scale biotope* (Frey, 1998) refers to all those landscape elements that, while not abundant, influence the presence of various avian species and should therefore be quantified. These microsites, which have a significant impact on the avian community, include examples such as bodies of water like small fountains (Dulisz & Nowakowski, 1996) or larger ones (Natuhara & Imai, 1996), isolated trees, waste containers, food provided for cats, protruding architectural elements serving as perches, etc. The vegetation present should be categorized into native and non-native species, as this represents a significant element of selection, both qualitatively and quantitatively, concerning the species present (Mills *et al.*, 1989).

Data collection

The factors that make traditional survey methods challenging to use in urban environments include noise, access and visibility limitations, a high percentage of non-territorial species, and various logistical issues. The mapping method (*sensu* Pough, 1947), rightly recommended by Dinetti & Fraissinet (2001) and Dinetti (2005) for identifying and quantifying the nesting community in city parks, encounters significant challenges in areas with a high percentage of ground covered by buildings. For the study of urban bird communities, Landmann (1990) proposes the *Grid Area Count points Method*, which is a combination of the mapping method and the point count index. Witt (1994) employed a discrete value scale in Berlin for a semi-quantitative assessment of the avian population. In any case, a quantitative assessment of the present population can only be relative in nature. To compare the efficiency of detecting the present avian community, I applied two of the most commonly used methods in natural environments: the line transects (Järvinen & Väisänen, 1976; Emlen, 1977) and the point counts methods (Blondel *et al.*, 1970), both without limits on observation distance. In avian populations with a high percentage of non-territorial species, especially outside the breeding season, the line transect method is recommended (Storch & Kotecky, 1999; Bibby *et al.*, 2000). Between November 20th and December 20th, 1995, and between April 1st and May 31st, 2000, I conducted 18 line transects of 900 meters each, and along the same route, and I performed 20 10-minute surveys through randomly selected point counts within the urban area of Ladispoli. During those years, this city, with a population of approximately 23,000 inhabitants, stretched along the Tyrrhenian coast and was bordered by areas of natural vegetation, mainly Mediterranean scrubland, and agricultural zones. The urban infrastructure primarily comprised two to three-story buildings, although multi-story buildings were also present. Almost all constructions were surrounded by green spaces. The settlement type could thus be described as a mixed buildings/villas pattern, where percentages consistently below 50% of the surface area were occupied by gardens, open spaces, and uncultivated areas.

Comparing the maximum number of individuals of various species recorded during the months of November-December 1995 using the two methods (Tab. 1) cannot be logically conducted. However, the frequency of various species does not exhibit a statistically significant difference ($\chi^2 = 0.89$; $P = 0.35$; Friedman test). I also calculated the following community parameters using the data collected with the two methods: S = species richness, the total number of species recorded; H' = diversity index (Shannon & Weaver, 1963); J = evenness index (Lloyd & Ghelardi, 1964). The line transect method allowed for the detection of 22% more species. The diversity index shows significant differences, with a notably higher value using the line transect method. The evenness index indicates a more equitable distribution of species when employing this method. The value of the turnover index (Wiens & Dyer, 1975), which can range from 0, indicating no change, to 1, indicating total change, resulted to be 0.22. From April 1st to May 31st, 2000, at the same survey location as before, I conducted 28 line transects of 900 meters each and 18 10-minute surveys through point counts. Similarly, the frequency of various species recorded using the two methods (Tab. 1) does not exhibit a statistically significant difference ($\chi^2 = 0.25$; $P = 0.62$; Friedman test). Using the line transect method allowed for the detection of one additional species compared to the point counts method, yet the community indices do not indicate substantial differences. The turnover index value is exceptionally low at 0.06. The apparent higher efficiency of the line transect method during the winter season could be attributed to the increased mobility of species during this period, thus resulting in higher chances of encounter along a sample route compared to fixed point counts; this is despite the limitation posed by the extreme variability of lateral visibility.

Table 1. Maximum number of individuals, frequency, and community indices (S = species richness, H' = diversity index, and J = evenness index) of species recorded using the line transects and point counts methods between November 20th and December 20th, 1995, and between April 1st and May 31st, 2000, in Ladispoli (Rome).

	November-December 1995				April-May 2000			
	Line transects		Point counts		Line transects		Point counts	
Species	Maximum number of individuals	%	Maximum number of individuals	%	Maximum number of individuals	%	Maximum number of individuals	%
Streptopelia decaocto	3	3.4	2	5.7	4	3.7	3	5.5
Apus apus	-	-	-	-	40	37.0	22	40.0
Pica pica	6	6.7	4	11.4	6	5.6	2	3.6
Corvus monedula	2	2.2	0	0	-	-	-	-
Cyanistes caeruleus	1	1.1	0	0	2	1.9	1	1.8
Parus major	3	3.4	1	2.9	4	3.7	2	3.6
Delichon urbucum	-	-	-	-	7	6.5	3	5.5
Phylloscopus collybita	2	2.2	0	0	-	-	-	-
Sylvia atricapilla	7	7.9	2	5.7	4	3.7	2	3.6
Sylvia melocephala	4	4.5	2	5.7	1	0.9	1	1.8
Sturnus vulgaris	12	13.5	5	14.3	6	5.6	4	7.3
Turdus merula	8	9.0	2	5.7	10	9.3	3	5.5
Erithacus rubecula	4	4.5	1	2.9	-	-	-	-
Phonicurus ochruros	6	6.7	2	5.7	-	-	-	-
Regulus ignicapillus	1	1.1	0	0	-	-	-	-
Passer italiae	9	10.1	3	8.6	5	4.6	3	5.5
Passer montanus	12	13.5	6	17.1	6	5.6	2	3.6
Motacilla alba	3	3.4	1	2.9	1	0.9	0	0
Chloris chloris	2	2.2	2	5.7	6	5.6	4	7.3
Carduelis carduelis	4	4.5	2	5.7	3	2.8	1	1.8
Serinus serinus	-	-	-	-	3	2.8	2	3.6
S	18		14		16		15	
H'	2.62		1.64		2.28		2.20	
J	0.91		0.62		0.82		0.81	

During the spring season, the two methods do not appear to show substantial differences, likely due to the increased territorial behavior of species. However, it should be noted that given the fragmented nature of the study environment, the point counts method is more influenced by the randomness of encountering individual species. The urban environment can be seen as an exaggeration of landscape fragmentation, influenced not only by the structural features of buildings and the physiognomic characteristics of garden vegetation but also likely by local microclimatic variations.

“Canopy” effect

From April 19th to May 13th, 2004, I conducted six 15-minute point counts from street level and six surveys from the terrace of a six-story building, in random chronological order, approximately 20 meters above ground level, at Piazza Buenos Aires in Rome.

Table 2. Maximum number of individuals and community parameters recorded from street level and the roof of a building in Rome.

Species	Street level	Roof of the building
	Maximum number of individuals	Maximum number of individuals
Columba livia	12	3
Apus apus	6	18
Larus michahellis	1	6
Falco tinnunculus	0	1
Corvus monedula	0	22
Corvus cornix	2	6
Cyanistes caeruleus	1	0
Sylvia atricapilla	1	0
Troglodytes troglodytes	1	0
Sturnus vulgaris	1	7
Turdus merula	2	0
Monticola solitarius	0	1
Regulus ignicapillus	1	0
Passer italiae	2	6
Motacilla alba	0	1
Serinus serinus	0	2
S	11	11
H’	1.91	1.95
J	0.80	0.81

In this series of surveys, the community parameters are nearly identical (Tab. 2), but the turnover index exhibits a notably high value of 0.63, highlighting the substantial differences between the two avian communities that are vertically separated by about twenty meters.

Comparison of line transects

From May 3rd to May 30th, 2007, I conducted a total of 20 line transects in Rome, each 400 meters long. Specifically, 10 line transects were carried out along Via della Conciliazione, stretching from Piazza Papa Pio XII to Piazza Pia, and another 10 line transects were performed along Via dei Corridori and Borgo Sant'Angelo, extending from the Largo del Colonnato intersection to the junction with Via di Porta Castello. Between the two parallel roads, there is a distance of approximately 60 meters, and they are separated by a single row of buildings. Via della Conciliazione has a width of approximately 40 meters and is pedestrianized for most of its length until the intersection with Via della Traspontina. Via dei Corridori and its extension, Borgo Sant'Angelo, have a width of approximately 12 meters. They are bordered by the Borgo Passageway, the 13th-century walls that connect the Vatican City to Castel Sant'Angelo. These roads are subject to vehicular traffic along their entire length.

Table 3. Maximum number of individuals, frequency percentage, and community parameters recorded along two parallel line transects in Rome.

Species	Via della Conciliazione		Via dei Corridori/Borgo Sant'Angelo	
	Maximum number of individuals	%	Maximum number of individuals	%
Columba livia	32	34.8	14	36.8
Apus apus	23	25.0	7	18.4
Larus michahellis	14	15.2	4	10.5
Corvus cornix	4	4.3	2	5.3
Delichon urbicum	6	6.5	2	5.3
Sturnus vulgaris	7	7.6	5	13.2
Passer italiae	6	6.5	3	7.9
Motacilla alba	0	0	1	2.6
Total number of individuals	92		38	
No. of species	7		8	
H'	1.51		1.49	
J	1.95		2.07	

The data presented in Tab. 3 highlight the significant differences that can be observed in the bird community even within a few meters of distance. These differences are partially attributed to the structural characteristics of the buildings but are mainly influenced by the distance from these structures, which strongly affects visibility. The difference in the number of species is not particularly significant, but the number of individuals observed on Via della Conciliazione is more than twice as much as the other route. It is noteworthy, however, that the frequency of various species observed in the two routes does not exhibit a statistically significant difference ($\chi2 = 0.50$; $P = 0.48$; Friedman test), community indices show no substantial differences, and the turnover index has a very low value (0.13).

Comparison between time intervals

In England, during the winter, it has been observed that in urban environments, birds have a later onset of foraging activity in the morning compared to rural areas (Ockendon *et al.*, 2009). However, in Italy, no correlation has been found between the time of observations and either the number of species or the number of individuals encountered (Dinetti & Lebboroni, 2012). From December 20, 1995, to January 25, 1996, I conducted 24 line transects of 900 meters within the urban area of Ladispoli. There were 12 line transects starting at 7:00 AM and 12 starting at 8:30 AM. For each species, I recorded not only the number of individuals but also the percentage of those contacted solely through acoustic means. Additionally, for each line transect, I noted the number of vehicles with the engine running, using this parameter as a measure of noise level.

Table 4. Species richness, maximum number of individuals, percentage of acoustic contacts, and average number of running automobiles encountered in 24 line transects conducted from December 20, 1995, to January 25, 1996, within Ladispoli (Rome).

	7.00 AM	8.30 AM
S	18	15
Maximum number of individuals	80	46
Percentage of acoustic contacts	40.0	10.9
Average number of automobiles	42	133

In the series of two line transects, spaced an hour and a half apart in terms of starting time, the number of species, despite showing a decrease in the later one, does not exhibit significant differences. However, the maximum number of individuals observed is considerably lower in the second line transect, which can be attributed to the lower percentage of acoustic contacts. The number of running automobiles is three times higher in the second set of line transects, which is certainly the reason for the reduced acoustic detectability (Tab. 4). It should be noted that the noise in the study area is relatively low; however, in large urban centers, the situation is certainly quite different. The number of moving vehicles could potentially even eliminate the number of individuals contacted acoustically. As an example, the Decree No. 84 of November 12, 2019, by the Municipality of Rome allows certain exempted activities to reach 70 dB(A), well above the intensity levels of vocalizations of many bird species (Dooling, 1982). Anthropogenic noises can also significantly alter the singing behavior of many species (Gill & Brumm, 2014; Halfwerk & Slabbekoorn, 2014).

Comparison between consecutive days

From April 18th to May 12th, 2016, I conducted 10 line transects spanning 1,800 meters in Rome, starting from the Cipro metro station, and passing through Piazzale degli Eroi, Via Andrea Doria, Viale delle Milizie, and concluding at the Lepanto metro station.

Table 5. Number of individuals of individual species, S = species richness, H’ = diversity index, and J = evenness index observed in 10 line transects from April 18th to May 12th in Rome.

Dates	*Columba livia*	*Larus michahellis*	*Psittacula krameri*	*Corvus cornix*	*Parus major*	*Delochon urbicum*	*Sturnus vulgaris*	*Turdus merula*	*Passer domesticus*	S	H’	J
18.04.2016	9	4	0	5	0	4	0	0	8	5	1.55	0.96
22.04.2016	3	4	1	2	0	0	1	2	6	7	1.77	0.91
26.04.2016	8	5	0	1	0	0	1	3	8	6	1.54	0.86
27.04.2016	9	1	0	10	0	0	1	1	3	6	1.38	0.77
28.04.2016	20	3	2	4	1	0	0	1	7	7	0.88	0.45
02.05.2016	4	7	0	3	0	0	0	2	4	5	0.92	0.57
04.05.2016	13	4	0	4	1	6	0	0	7	6	1.27	0.71
09.05.2016	9	3	0	5	0	1	0	0	2	5	1.37	0.85
10.05.2016	5	3	1	1	0	3	1	0	3	7	1.44	0.74
12.05.2016	129	6	0	1	0	6	0	0	7	5	0.43	0.27

Species richness, ranging from five to seven, does not exhibit substantial differences across the various line transects. However, the diversity index and evenness index show significant skewness values (-1.00 and -0.99, respectively) and leptokurtic kurtosis values (0.69 and 0.30, respectively; Kolmogorov-Smirnov test of normality) (Tab. 5). The data collected for *Columba livia* have a non-Gaussian distribution ($D = 0.41$; $P < 0.001$; Kolmogorov-Smirnov test of normality), high skewness values of 3.07, kurtosis values of 9.55, and an outlier. The values for this species logically influence the community values and highlight the difficulty of quantitative assessments as previously observed in other urban contexts (Fraticelli, 2021). The turnover index between one day and the next is highly variable, ranging from zero to 0.44, in demonstrating how random events, often not even detectable, can significantly influence the collected data.

Comparison between consecutive months

Between March 17th and April 15th, 2016, I conducted 10 line transects of 1,800 m each. Additionally, from April 18th to May 12th, 2016, I conducted another 10 line transects (following the same survey methodology as described in the preceding paragraph). This line transects were performed in Rome, starting from the Cipro subway station and spanning through Piazzale degli Eroi, Via Andrea Doria, Viale delle Milizie, and concluding at the Lepanto subway station.

Table 6. Maximum number of individuals and community parameters recorded in two series of line transects in Rome.

Species	March 17th - April 15th, 2016	April 18th - May 12th, 2016
	Maximum number of individuals	Maximum number of individuals
Columba livia	24	129
Larus michahellis	10	7
Myiopsitta monacus	2	0
Psittacula krameri	4	2
Corvus cornix	11	10
Cyanistes caeruleus	2	0
Parus major	2	1
Delichon urbicum	6	6
Sylvia atricapilla	1	0
Sturnus vulgaris	4	1
Turdus merula	2	3
Passer italiae	10	8
S	12	9
H’	0.87	0.65
J	0.35	0.29

The turnover index between the two series of line transects has a value of 0.25. In the second series of line transects, three fewer species were recorded, and the community indices show significant differences (Tab. 6). These differences could be attributed to the varying reproductive phases of the different species, but it is likely that random events, often not even detectable, may also play a significant role.

Comparison between years

In April 1993 and April 1994, I conducted five 15-minute qualitative surveys each, focusing solely on the presence of various bird species on Via del Serafico and five 15-minute surveys on Via Annibale De Gasparis in Rome. The two areas, approximately one kilometer apart from each other in a straight line, can be defined as sparsely populated discontinuous residential zones, according to the CORINE Land Cover classification 1.1.2 (Bossard *et al.*, 2000). In April 2003 and April 2004, I conducted five 15-minute qualitative surveys each, focusing solely on the presence of various bird species on Via Torino and five 15-minute surveys on Viale Italia in

Ladispoli. The two areas, approximately one kilometer apart from each other in a straight line, can be defined as continuously built-up residential zones, according to the CORINE Land Cover classification 1.1.1 (Bossard *et al.*, 2000).

Table 7. Species present in two areas in Rome in 1993 and 1994, and species present in two areas in Ladispoli in 2003 and 2004.

Species	Roma				Ladispoli			
	Area 1		Area 2		Area 1		Area 2	
	1993	1994	1993	1994	2003	2004	2003	2004
Columba livia	X	X	X	X	X	X	X	X
Streptopelia decaocto						X	X	
Apus apus	X	X	X	X	X	X	X	X
Pica pica					X			X
Corvus cornix				X				
Periparus ater		X						
Cyanistes caeruleus	X	X	X	X				
Parus major	X	X	X	X				
Sylvia atricapilla	X	X	X					
Sylvia melanocephala	X			X	X			X
Certhia brachydactyla				X				
Troglodytes troglodytes	X	X	X					
Sturnus vulgaris	X	X	X	X	X	X	X	X
Turdus merula	X	X	X	X	X	X	X	X
Muscicapa striata	X							
Erithacus rubecula					X			
Regulus ignicapillus	X	X		X				
Passer italiae	X	X	X	X	X	X	X	X
Passer montanus	X	X	X	X	X	X		X
Motacilla alba	X				X	X		
Chloris chloris	X	X	X	X	X	X	X	X
Carduelis carduelis	X							
Serinus serinus	X	X	X	X	X	X	X	X
S	17	14	12	14	12	10	8	10

The collected data highlight that there is not a complete correspondence between the species found in one year and the next (Tab. 7). The turnover index value between 1993 and 1994 in the first area of Rome was 0.24, and in the second area, it was 0.33. Similarly, between 2003 and 2004, in the first area of Ladispoli, the turnover index was 0.25, and in the second area, it was 0.30.

Conclusions

The description of the study area presents an extremely complex issue due to the high variability of elements that can characterize it. A general definition of the environment should always be accompanied by a list, and possibly quantification, of all those elements that can potentially influence the avian community, even in a theoretical manner. The line transect method appears to be the most suitable during the winter season, while during the breeding season, no substantial differences have been highlighted between this method and the point counts. In areas where the majority of buildings have considerable heights, it should be considered that two distinct avian communities are present, separated by only a few meters vertically from each other. Finding a solution to this issue is certainly not straightforward, especially considering that for some species, there is the ability to move rapidly between different height layers, allowing them to be monitored or, conversely, to hide from sight. When selecting the line transect route, or choosing point counts, wider roads are preferable, also because the observation time for a species flying across the airspace is greater. Irrespective of the activity rhythms of various species, it is preferable to conduct surveys as early as possible in the morning, a period during which anthropogenic noises, which could significantly reduce acoustic detectability, are theoretically lower. From the data collected in the comparison between two sets of line transects, both comparing consecutive hours and days, it is advisable to carry out a high number of surveys, at least 15. This is due to the unpredictability of contacts and the likely non-uniform breeding season for all species, with some species starting their breeding season earlier than rural populations (Deviche & Davies, 2014). A high number of surveys could also help mitigate the effect of stochastic events, such as the temporary availability of trophic resources like discarded waste on the street. Data collected in different years demonstrate that it is not possible to associate session data with a longer period, as changes in the structure of an urban avian community occur very rapidly due to the highly dynamic biological nature of this environment (e.g., Fraticelli, 1996; Morneau *et al.*, 1999; Fraissinet, 2010; Fidino & Magle, 2017). All the considerations put forth, however, must be critically evaluated with utmost care, as they have undoubtedly been strongly influenced by the contingent situation at the time of data collection.

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